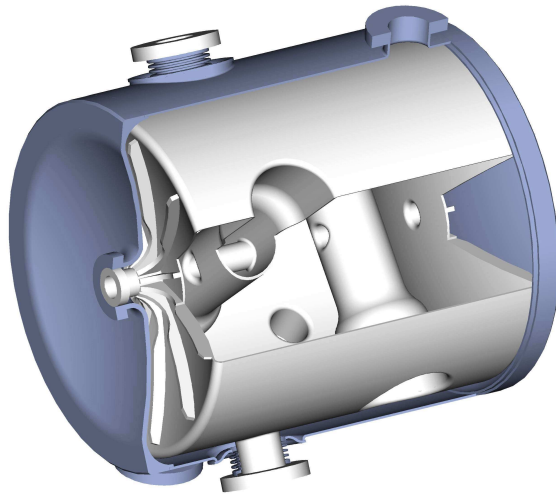# RIA Spoke Resonator Cryomodule Designs
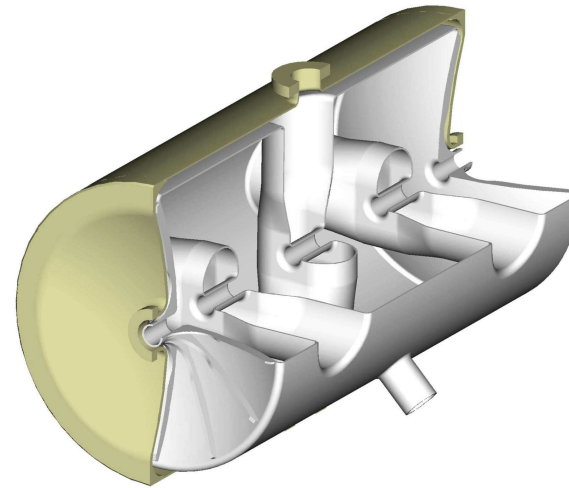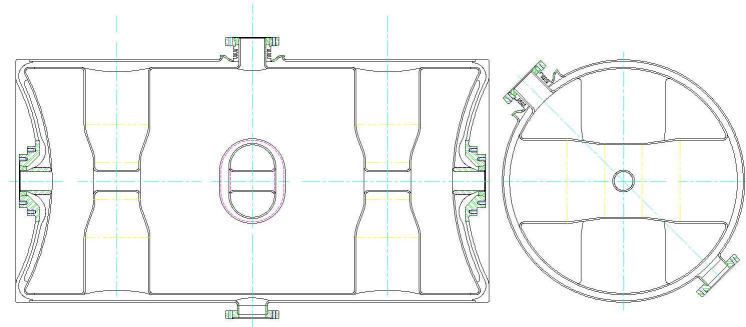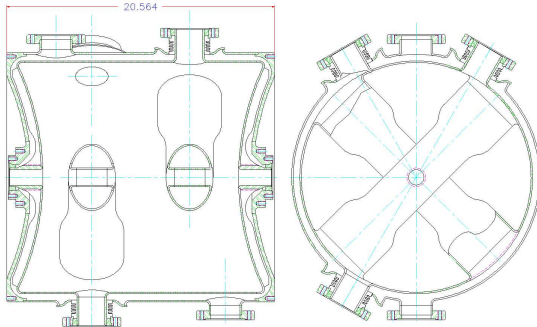
Joel Fuerst

Argonne National Laboratory

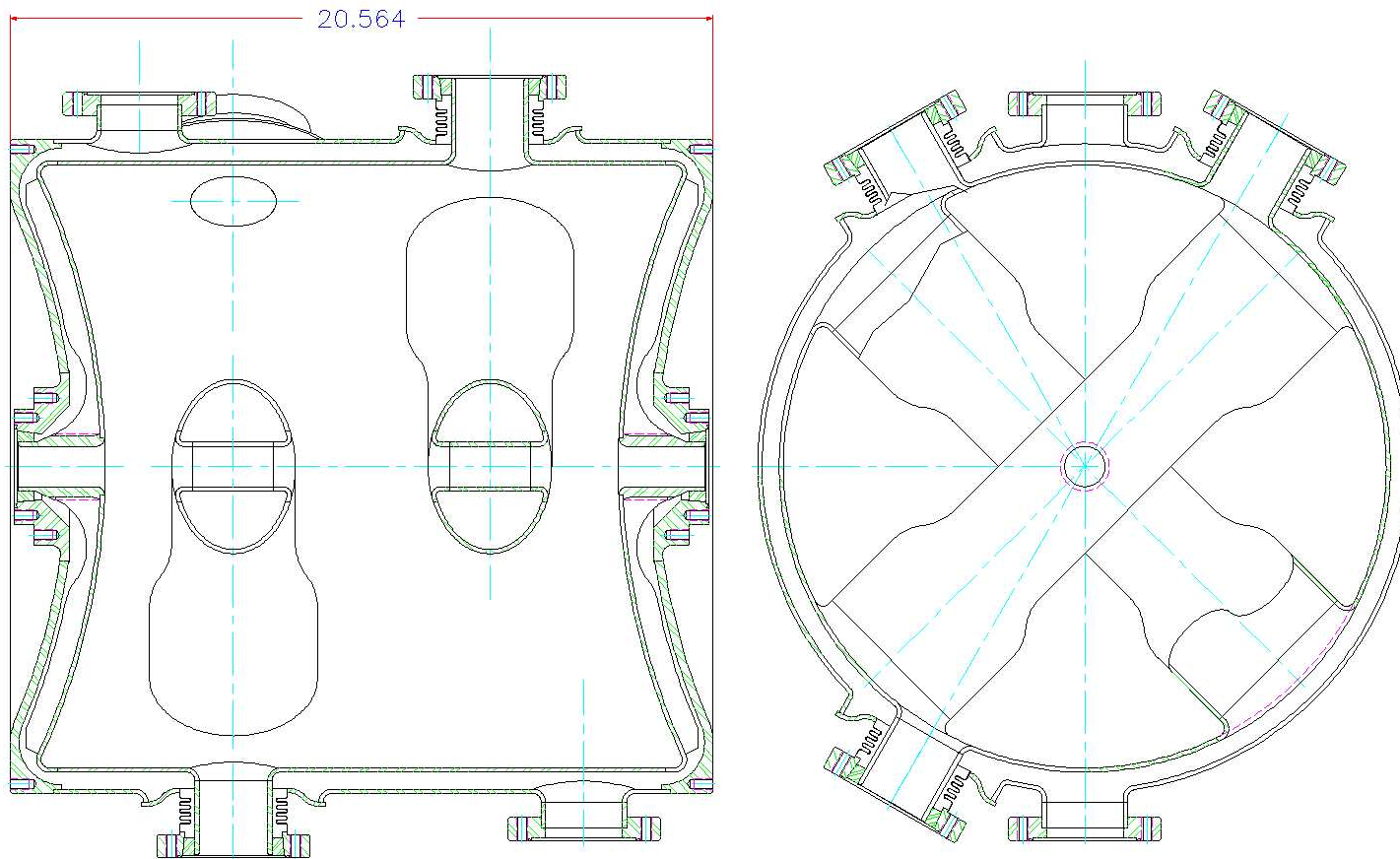# RIA Spoke Resonator Geometries

~63 3-gap cavities required for std. driver design (9 modules)

170 4-gap cavities required for alternative design (48 modules)

316L SS LHe vessel

- SS shell with CF flanges using commercial Cu gaskets
- straightforward TIG welded shell

Flange Design

• each cavity has 2 beam flanges (3.37" or 4.5" CF) and 3 side flanges (4.5" CF)

• 316L SS CF flanges brazed to Nb ring at 982 C using 82% Au, 18% Ni alloy (mp 949 C)

• excess Nb keeps temp below 700 C during ebeam weld, is machined away after welding
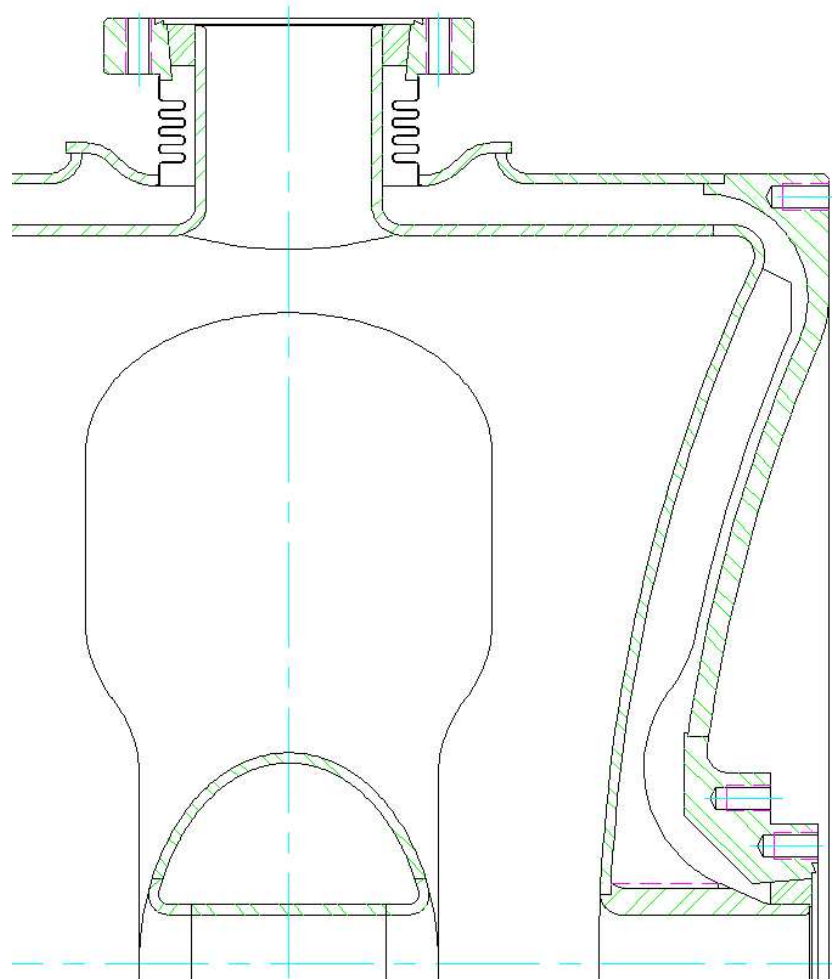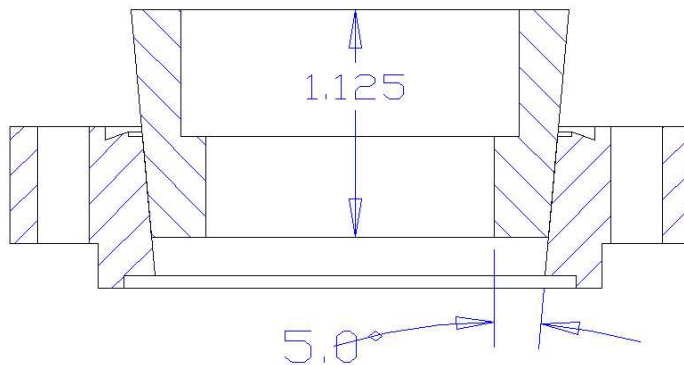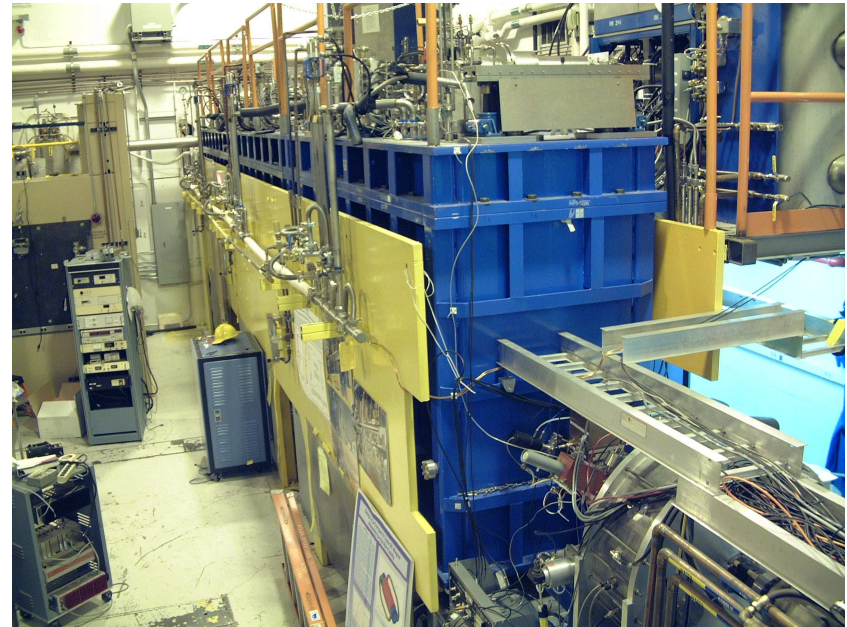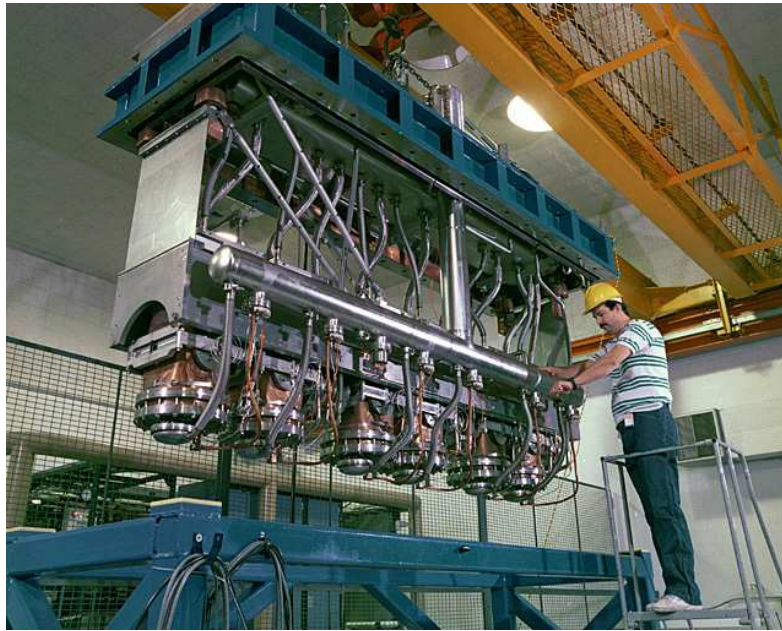
Displacement due to 15 psi load for alternative SS head geometries

$\Delta f/f = -1.43E-5$ $\Delta f/f = 6.86E-6$
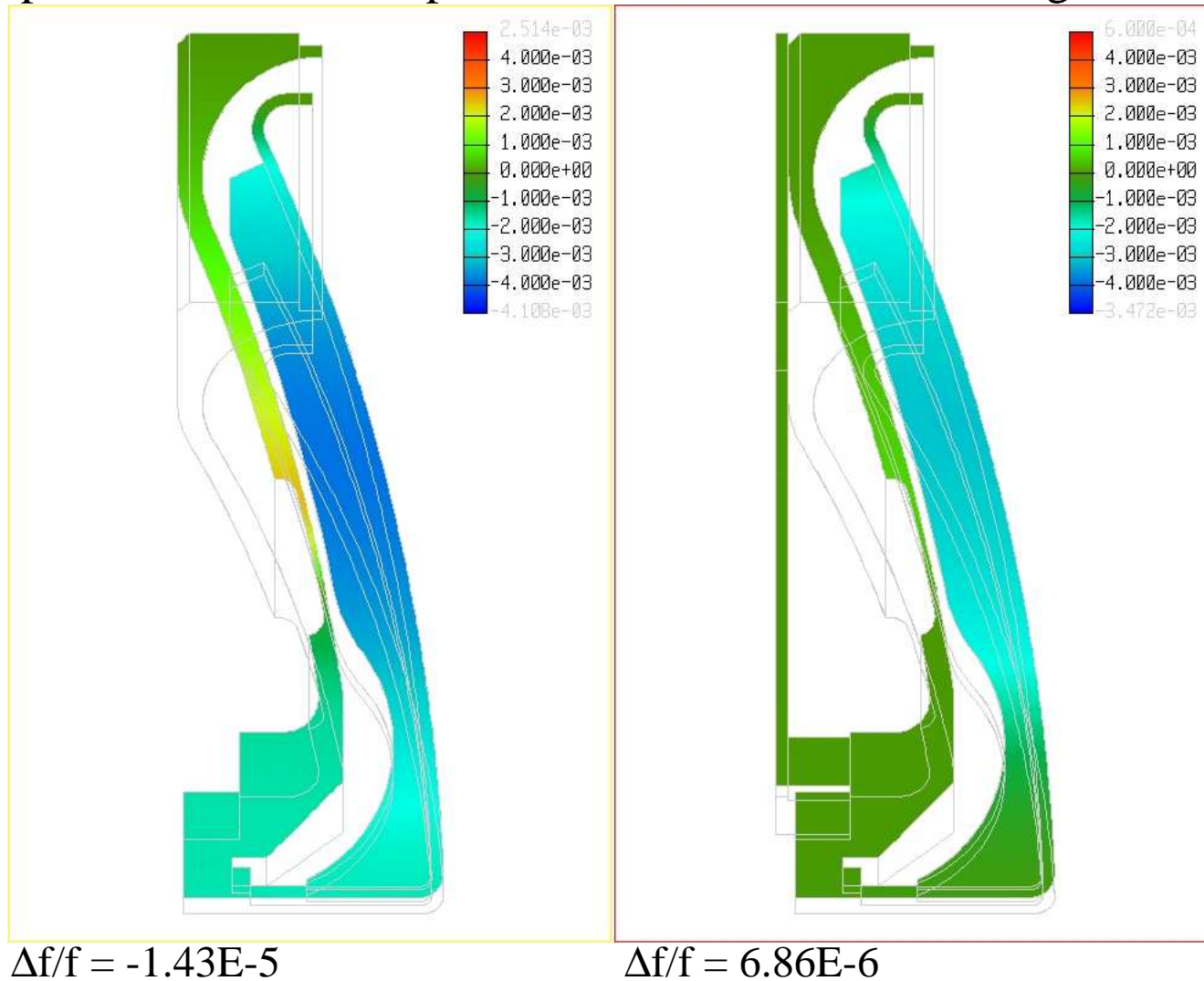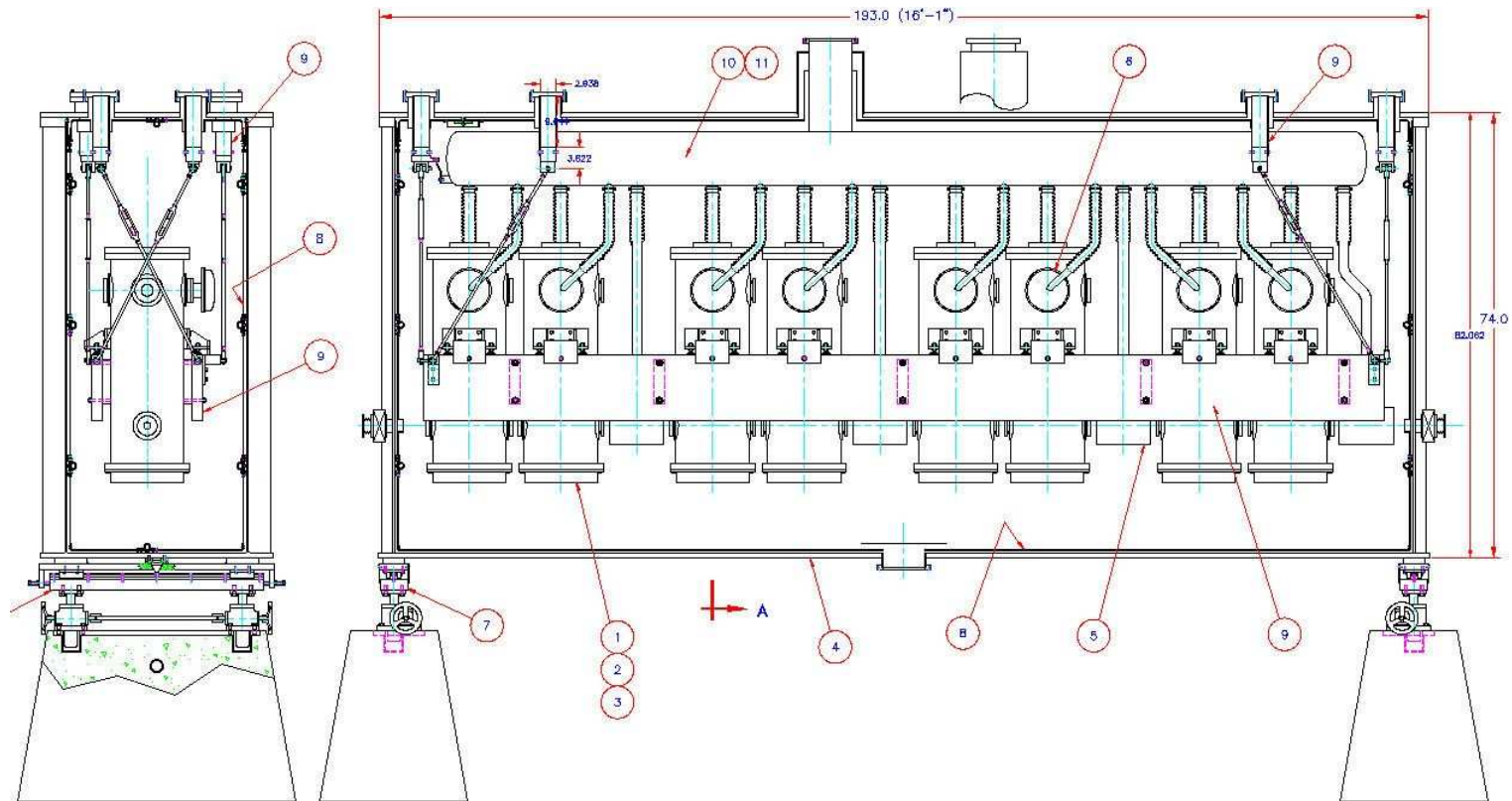
Endwall displacements
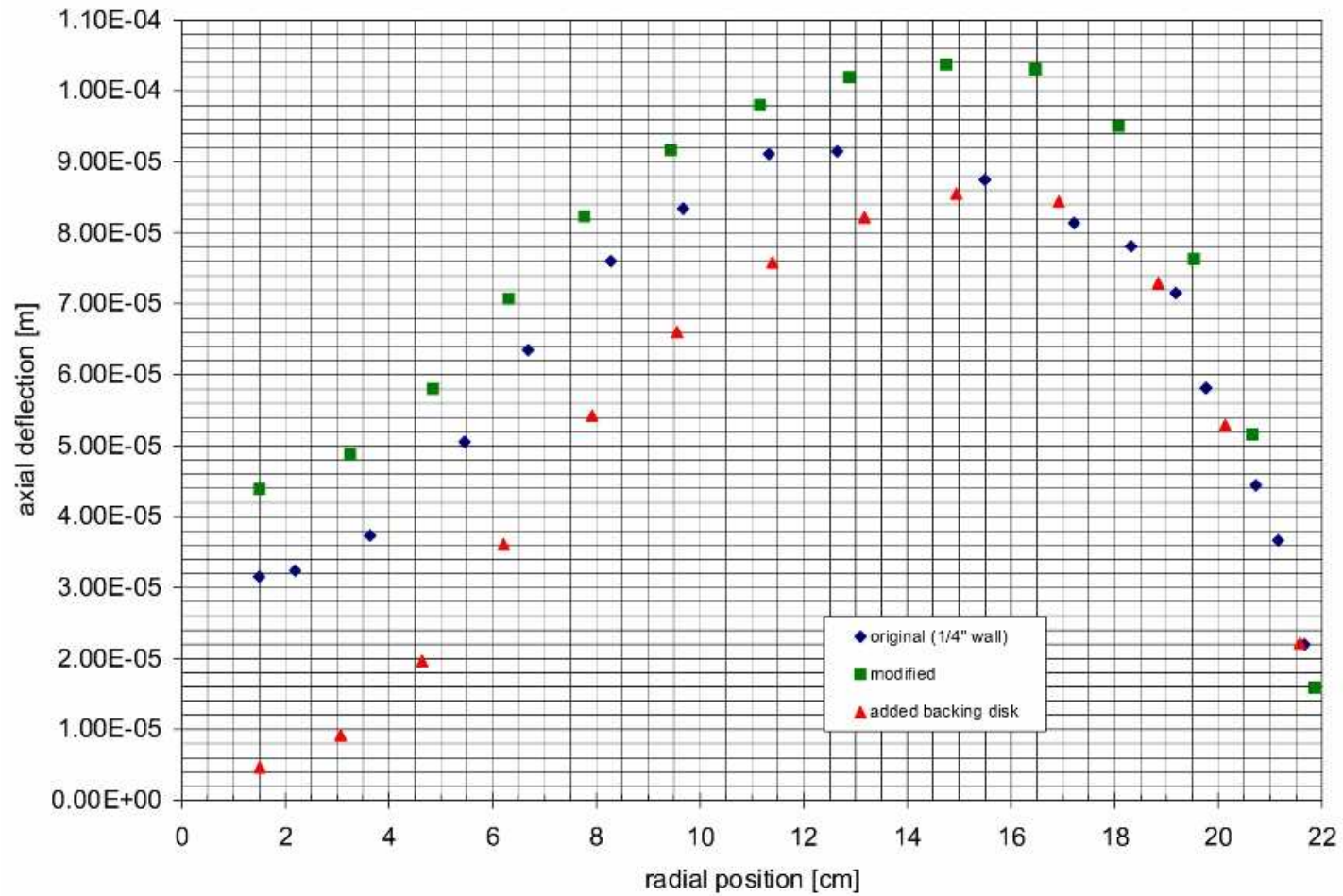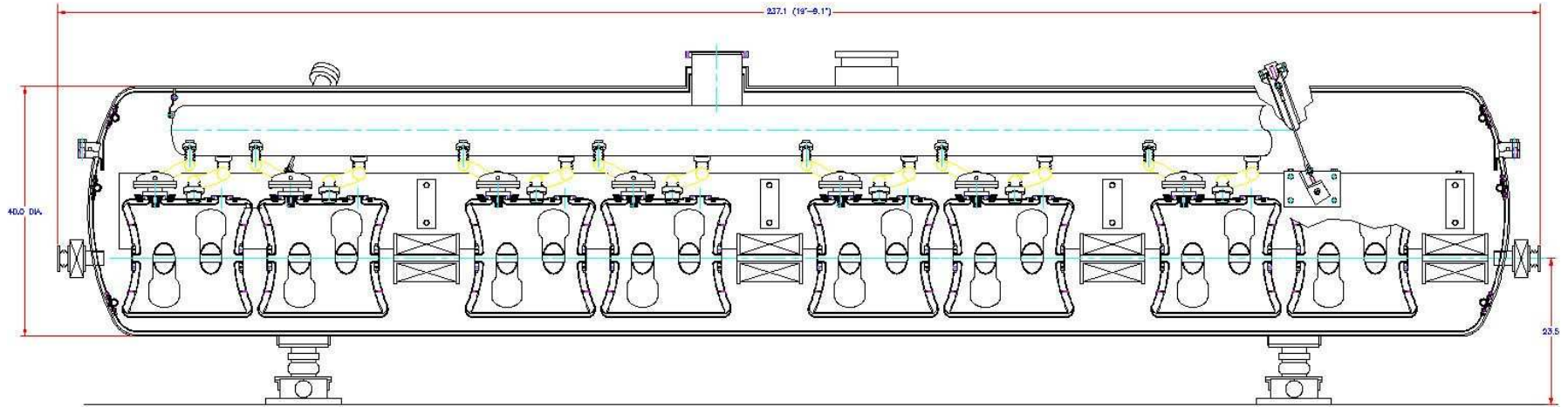
ATLAS Positive Ion Injector Cryomodule

- •Space efficient design
- •Top loading
- •Versatile
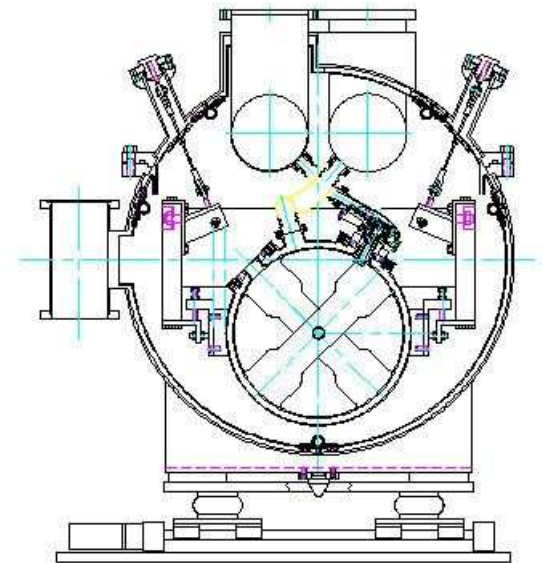- •Straightforward alignment capability

Design Evolution

- Based on ATLAS PII cryomodule
- Top loading
- Common vacuum vs. separate vacuums: cleanliness
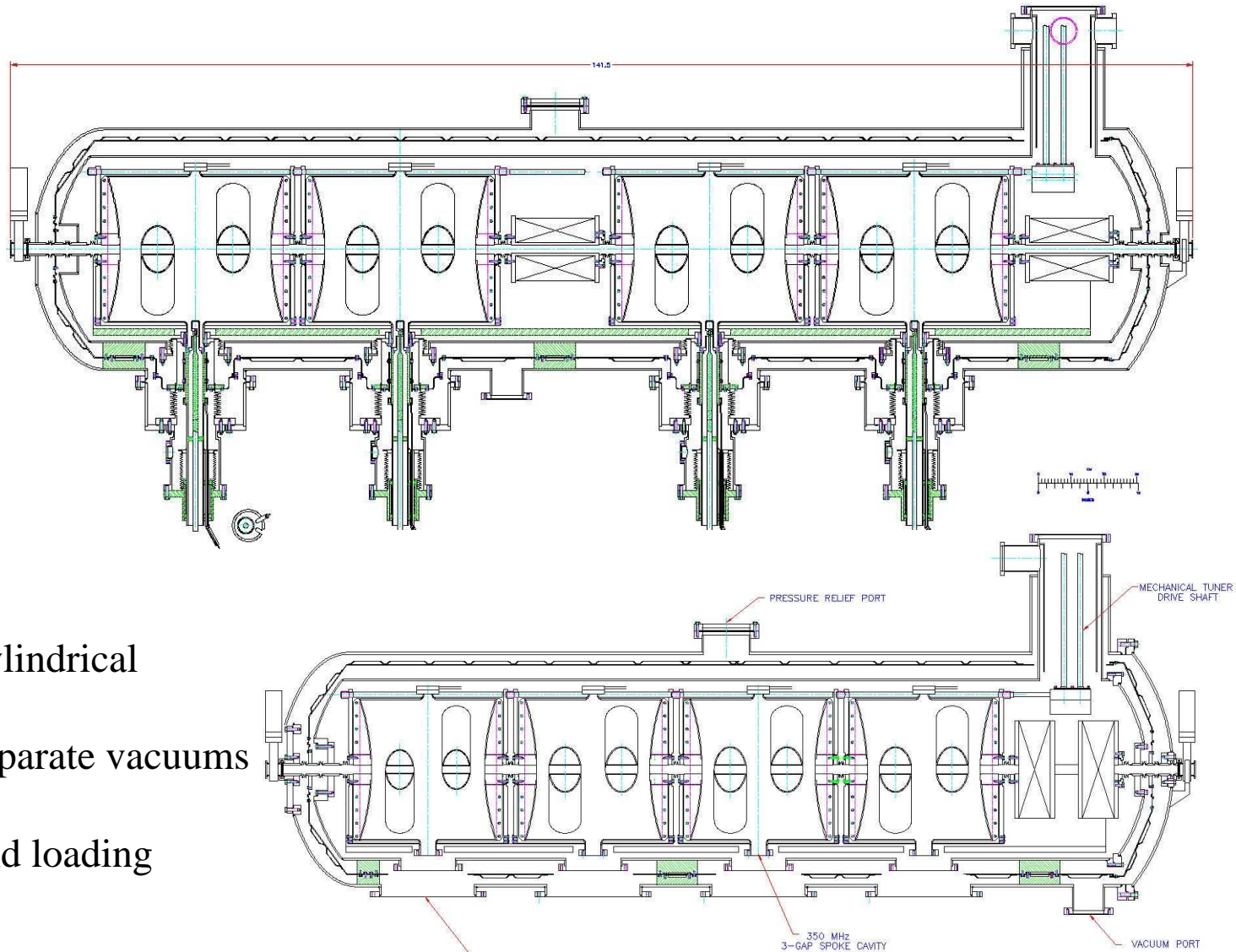- Length is driven by cost, handling issues

Design Evolution

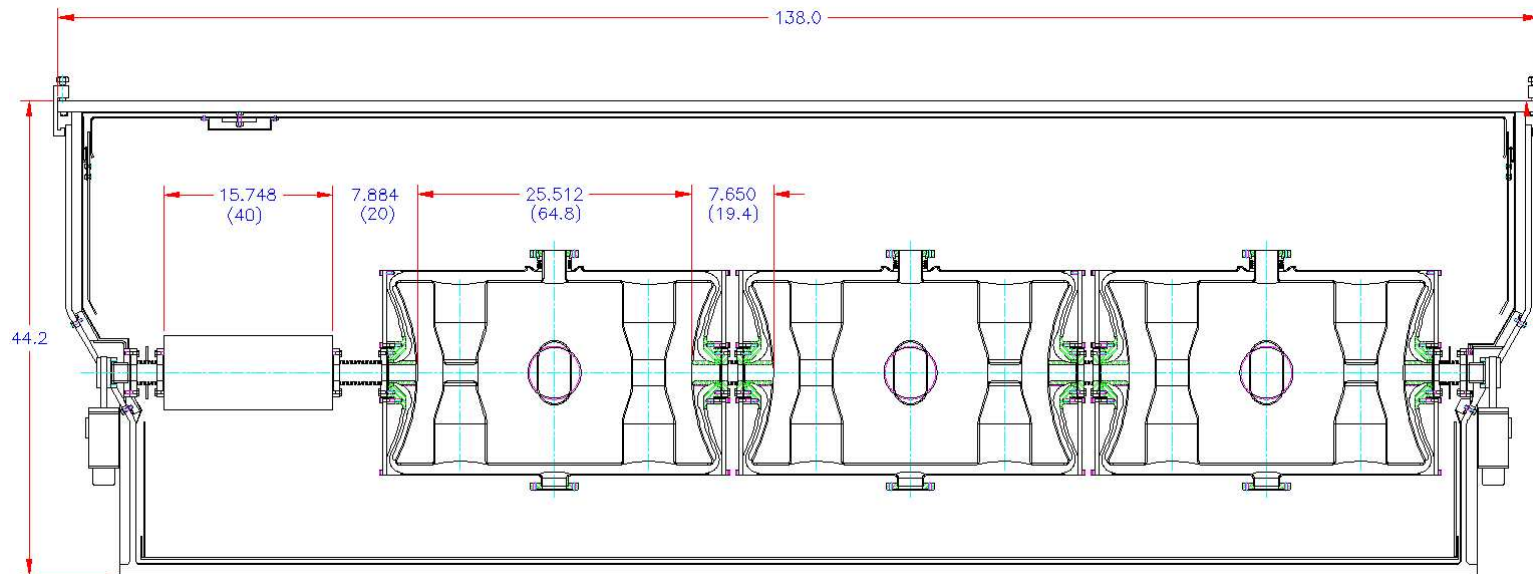•Cylindrical

•Common vacuum

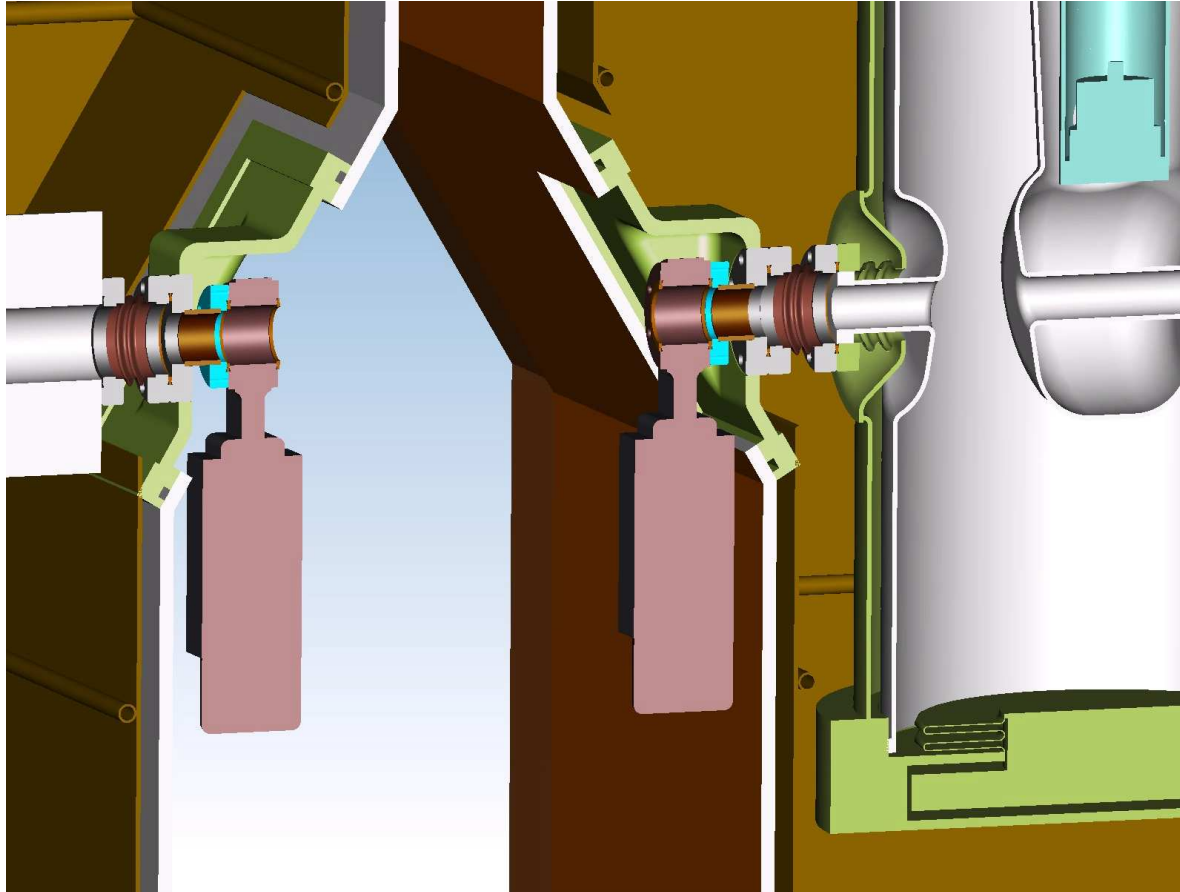•Top loading

Design Evolution

• Cylindrical

• Separate vacuums

• End loading

# Box Cryomodule with Separated Insulating and Beam Vacuums

- Reconciles separate beam and insulating vacuum spaces with short module-to-module spacing
- Constructive feedback from JLab, DESY

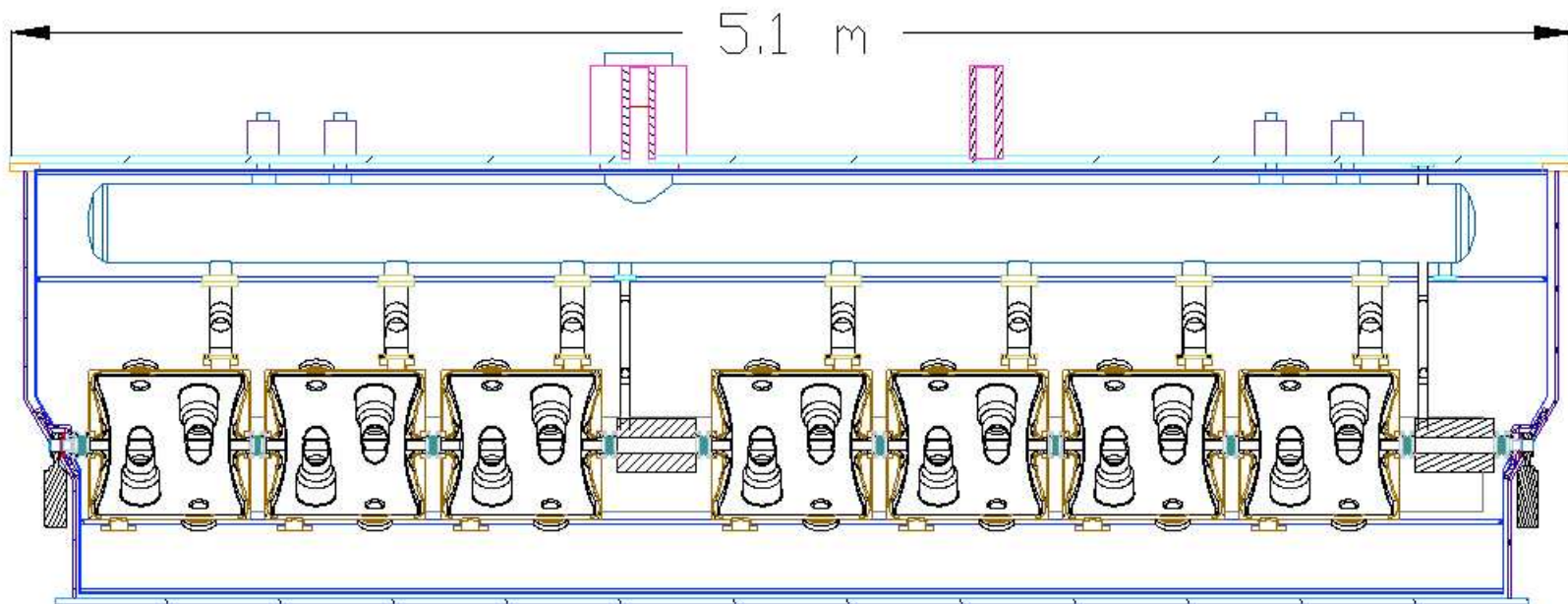# Separate insulating and beam vacuums

- Angled end walls permit drop-in installation
- Valves isolate clean components during final assembly
- Cleanliness requirements on vacuum vessel are relaxed
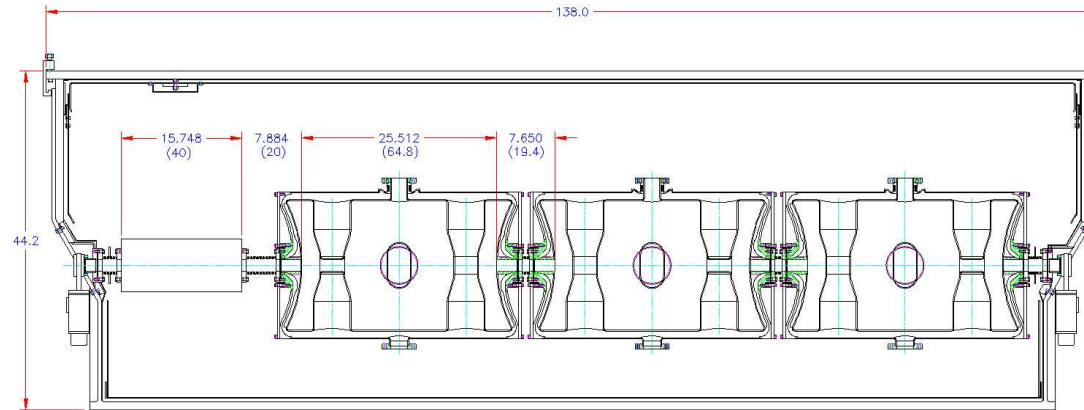- Allows use of multilayer insulation
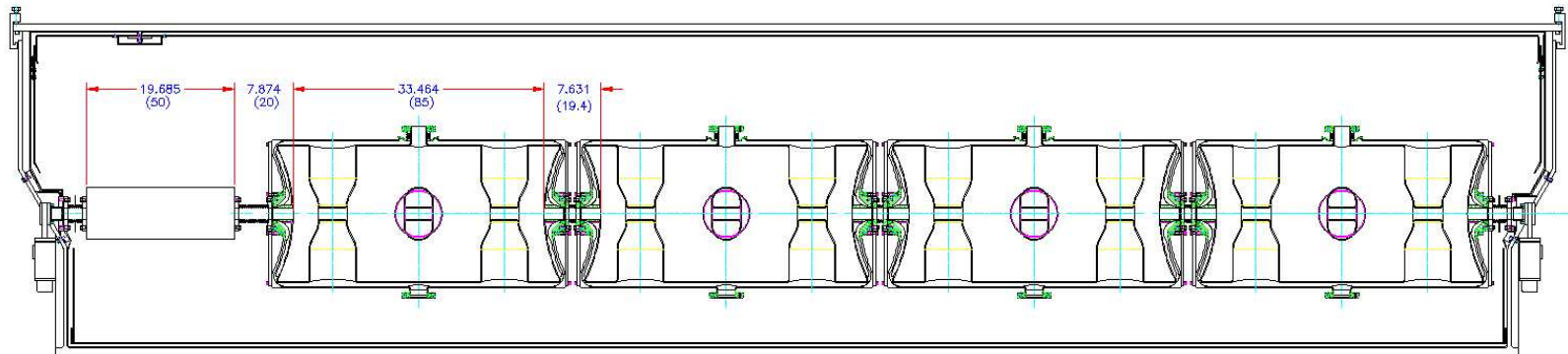
Module-to-Module Detail

61cm
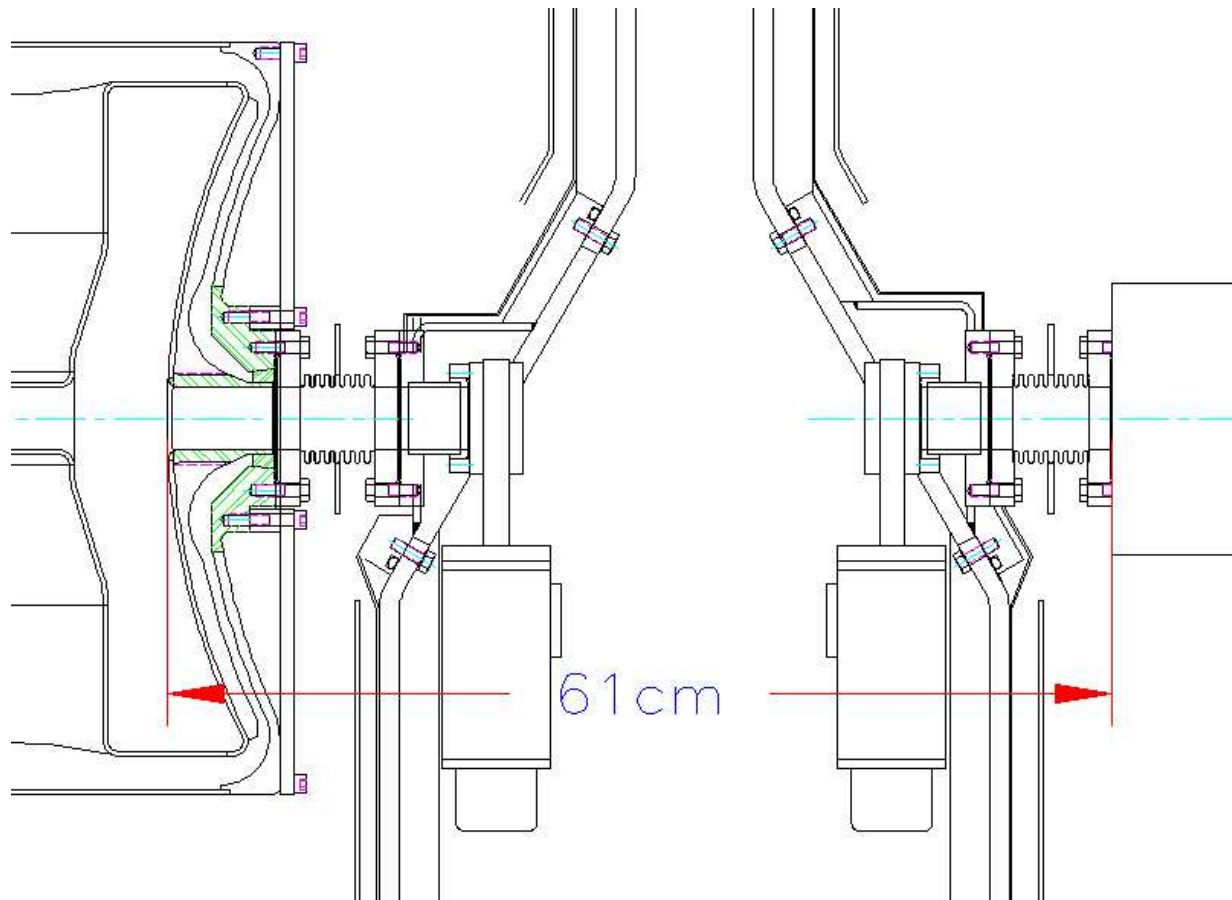
345 MHz β=0.36 Box Cryomodule

5.1 m

3-Spoke Cryomodules

β = 0.50

β = 0.62

Conclusions

- Box cryomodule concept builds on successful ATLAS PII design, end-loading cylindrical designs are proven at TTF, JLab, SNS, etc.

- Although rectangular shape is a good fit for a variety of drift tube cavity geometries, cylindrical may be more appropriate for spoke cavities

- Addresses gradient issue with separate beam vacuum and clean assembly techniques

- Preserves tight module-to-module spacing in a top- or end- loading design with separate vacuum systems